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METHOD FOR MAKING MULTI-LAYER, PERSONNEL-PROTECTIVE HELMET SHELL ~~WITH SPRAY-FABRICATED INNER AND OUTER STRUCTURAL LAYERS~~

Background of the Invention

The invention pertains to personnel-protective (blunt object impact and noise suppression) helmet shell construction, and in particular, to such a shell, and to a method of making the same, where inner and outer, load-bearing, semi-rigid structural layers in the shell are formed/fabricated by the process of vapor-suspension, material-spray deposition. Preferably employed for such a structural spray is a two-component, polyurea/polyurethane spray elastomer system, such as the component system known as HYDROTHANE made and sold by Hydroseal Polymers, Inc. of Riverside, California. The two components making up this product are isocyanate and polyol. We have discovered that this commercially available system, which is focusedly designed to create protective coatings over other objects, can itself be employed to form independent structural object per se. This discovery opens the door to the moldless creation of many different kinds of structural objects, such as the helmet shell structure which is particularly disclosed and illustrated herein.

This spray material, appropriately prepared for spraying as a particle vapor-suspension, includes particles having a strong bonding affinity for one another upon contact. Contacting particles conglomerate after landing with one another to form, progressively, a solid, semi-rigid, load-bearing structure. The "exposed" surface of this forming structure has an infinitely and subtlety selectable and controllable topography,

Turning now to the drawings, in an appropriately formed, open-topped, female well, or cavity, 10a in a structure 10, a central core layer 12 of suitable soft, pliable and compressible, viscoelastic, microcellular foam material is placed to conform generally complementarily to the shape of this well. Provision of structure 10 with its cavity 10a is referred to herein as preparing (at least partially) an environment fro the reception of a spray material. An appropriate material for core layer 12 is the viscoelastic, acceleration-rate-sensitive, noise-suppressing urethane material called PORON®, made by Rogers Corporation of Woodstock, Connecticut, and sold as one of the urethane products in the PORON® 4000 Performance Urethane 90 Series line of products offered by that company. The material preferably chosen from this line exhibits a rebound characteristic lying in the range of about 5%-10% rebound, as determined in a standard ASTMD 2632-90 Vertical Rebound Resiliency Test, and most preferably possesses about 8% ~~reound~~ rebound. Also, the selected viscoelastic material exhibits an energy dissipation characteristic lying preferably in the range of about 0.5-0.9, according to a standard TAN Ä Energy Dissipation Ratio Test, and most preferably about 0.7.

Preferably, this core material is initially prepared by precision die-cutting of a starter shape, or blank, from a sheet of the mentioned material. Such preparation is referred to herein as shaping. While natural shape-memory in the core material sheet will cause the die-cut blank thereof to tend to fit with its outside surface 12a snugly against the inside surface of well 10a, it is preferable to assure an initially stable, conforming fit by employing a suitable coating of any conventional light-duty, easy-release contact adhesive on the well's surface. Anther appropriate manner of establishing a conforming